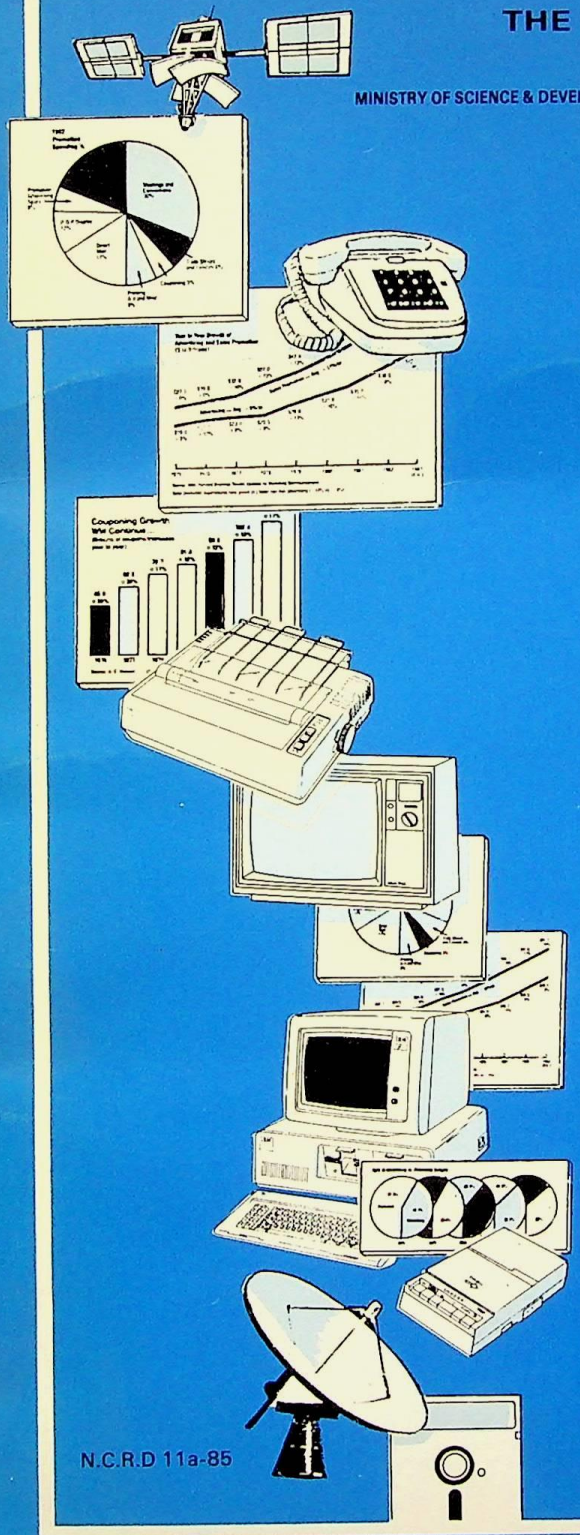
THE STATE OF ISRAEL

MINISTRY OF SCIENCE & DEVELOPMENT

MINISTRY OF COMMUNICATIONS



National Steering Committee for Information Technology

Final Report

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INTRODUCTION

The Israeli Steering Committee for Information Technology was appointed in February 1983 by the Minister of Science and Development together with the Minister of Communications, in accordance with a decision of the Ministers' Committee for Science and Technology. The remit of the Steering Committee for Information Technology (IT) was to discuss the issue of IT in Israel, and to submit IT policy proposals including projects and national priorities to the government. The Committee set up ten sub-committees to deal with various aspects of the question. These sub-committees started reporting back to the Plenary Committee in January 1984. Their reports were scrutinized by the plenary body, and after the necessary changes were submitted to the government. To date, a total of nine reports have been completed and submitted: seven committees have submitted final reports, two have submitted a joint interim report, while one committee has not submitted a report at all.

This report is a summarized and translated version of the tenth and final report of the Steering Committee.
This version is intended for distribution among interested circles abroad who wish to acquaint themselves with the main findings and recommendations of the Steering Committee. It has been kept concise for the convenience of the reader.

The first chapter gives an overview of the Committee's findings and recommendations. These are based on the sub-committees' discussions and reports, as well as on the plenary deliberations. This summary is designed to present the Committee's recommendations as a list of national aims and policy guidelines for information technology, with a corresponding list of fourteen major recommendations for action selected in order of priority from the many recommendations of the subcommittee reports. Chapter 2 reviews and discusses the economic and social implications of the development of the information era in Israel. This chapter is an attempt to give a wider-ranging picture, so as to discuss not only the significance and trends of the likely development and impact of the information era, but also the action required to avoid undesirable and harmful developments. Chapter 3 contains a summary of the committee's recommendations on certain major issues of common concern to several committees.

This report is therefore a summary of the almost three years' work of the Plenary Committee for Information Technology and its subcommittees. Scores of people were involved in the work, most of them giving their services voluntarily and in their free time. Thanks and appreciation go to the chairmen for their endeavours, patience and perseverance which culminated in the committee's reports, without forgetting the contributions of the subcommittee members whose initiatives, insistence and unflagging assistance were crucial for the completion of the reports.

Special thanks go to Dr. Menachem Tassa who joined the Steering Committee in December 1983 as deputy chairman, and who until he left in August 1985 for an assignment abroad was involved intensively in the work of the Committee, making a considerable mark on part of the reports. Last but not least, thanks to Esty Newman who joined the active team in August 1983 as coordinator of the Steering Committee for Information Technology. Working unflaggingly and indefatigably she spurred on the committee, acting as meeting secretary, coordinating meetings, when needed acting as typist, as well as drafting, editing and publishing the reports. Without her indispensable contribution it would have doubtless taken many more months for the Steering Committee to reach this report.

This report, like its predecessors, is submitted to the government in the hope that its recommendations will be considered positively and that all possible efforts will be made to implement them. The greatest reward which those who worked on preparing these reports can hope for, is vigorous progress in the field of information technology in Israel, and the steering of the right course in order to bring about a flourishing information society.

Dr. Jehuda Kella
Chairman, Steering Committee

CHAPTER 1 – FINDINGS AND RECOMMENDATIONS

1.1. FINDINGS

The deliberations of the plenary Steering Committee for Information Technology and its sub-committees generated a comprehensive picture of the IT situation in Israel. The major findings and their concommitant implications according to the sub-committee reports and the plenary discussions are given below.

1.1.1. On the basis of approximate estimates, in the absence of any precise statistical information, the Israel economy may be assumed to have one computer (excluding personal computers) per 200 staff, and one terminal for every 15 workers. Some 1.5% of all employees are involved directly in operating, maintaining, programming and developing IT applications (excluding computer users). In recent years the installed base of computers and computer-related hardware market has grown by some 35% annually. some 2% of the resources available to the Israeli economy are invested in acquisition and maintenance of computers and software.

1.1.2. There is a considerable shortage of qualified staff trained in IT at higher-education establishments, hundreds more being required to satisfy the growth in market demand. Today there is a shortfalll of several thousand graduates in the computer and electronics fields.

1.1.3. A disquieting lack of computers science and electronics faculty members in the Israeli academia is to be noted. While higher-education institutions in Israel have computing centres and computing power which are adequate for current needs, there is yet no super-computer in Israeli higher-education institutes.

1.1.4. The Israeli telecommunications infrastructure does not comply with the market requirements for data communications. Gaps exist between demand and supply of service, as well as between required quality and existing maintenance levels. The telecommunications infrastructure is a slowing down factor in the development of IT systems in Israel (see 3.1.1.).

1.1.5 Large-scale possibilities exist for using IT in the government sector in order to improve cost-effectiveness and efficiency but these are not as yet being fully exploited. The government sector is currently lagging far behind the rest of the economy, in its use of IT resources.

1.1.6. Current inter-ministerial divisions of responsibility for IT development

and development of IT staff for government IT applications have led to an unsatisfactory situation.

1.1.7. The Ministry of Education has been trying for several years to bring computers into the schools. Some 1000 out of 2400 schools are equipped with personal and other computers for teaching purposes. However, computer studies have not readily been accepted as an integral part of the educational system, and due to the lack of qualified instructors, it has not been possible to make proper use of equipment already installed. There is a need to develop educational programmes and learning aids. Budgetary appropriations for equipment and maintenance purposes are inadequate (see 3.1.2.).

1.1.8. Although the Israeli health system is equipped with computers, it does not gain the possible benefits from them due to the absence of coordination between health authorities and the absence of national data banks on health-related matters.

1.1.9. There is no detailed, authoritative information on computers in the Israeli economy: the Central Bureau of Statistics ceased publishing the computers and terminals survey in 1981.

1.1.10. The Israeli software industry is constantly expanding. Over 150 software houses offer their services on the market, some of them selling programming and software maintenance services abroad, with an ever increasing turnover figure. Known exports of software currently total some 20 million dollars annually, and it is assumed that a further equivalent sum is exported but not officially reported. The government has initiated steps to bring the situation of the software industry into line with that of manufacturing.

1.1.11. The government of Israel does not provide direct support for development of IT systems and equipping industrial and commercial firms with computers.

1.1.12. There is no official government action to increase the general public's understanding and awareness of computerization and information technology. Most training and advertising today is provided by private firms.

1.1.13. In Israel today there are no computerized data banks accessible to the general public.

1.2. RECOMMENDATIONS

The Steering Committee for Information Technology has submitted a series of sub-committee reports to the government. Below are given the main recommendations of the sub-committee reports and plenary discussions, making up an overall picture. These recommendations are those which the Steering Committee considers should be given top priority.

1.2.1. Aims and National Policy Guidelines

The Committee recommends that the government adopt the following aims and policy guidelines:

1.2.1.1. Speeding up the development of national IT infrastructures
1) Faster development of the telecommunications infrastructure;
2) Reinforcement of training academic and professional staff in IT disciplines;

1.2.1.2. Advancing all levels of the Israeli school and educational system towards using IT for teaching purposes and expanding of computer instruction, in the school programmes.

1.2.1.3. Encouraging government, industrial and business circles to move into the information era by means of suitable government incentives.

1.2.1.4. Increasing the efficiency and quality of public, government and non-governmental services by increased use of IT possibilities.

1.2.2. Action Recommendations

Below are given the recommendations whose implementation the Steering Committee considers would contribute to attaining the above aims:

1.2.2.1. Faster establishment of a digital telecommunications infrastructure and data communications networks in Israel, and intensive operations in order to set up an integrated digital services network (ISDN).

1.2.2.2. Speedier introduction and increase in the rate of penetration of computer application courses in all Israeli schools by means of special increased budgetary appropriations.

1.2.2.3. A doubling within five years of the numbers of computer and electronics graduate from higher-education institutes by expanding the relevant departments using appropriate methods.

1.2.2.4. Assigning a team to set up a national project for developing computer-aided teaching systems.

1.2.2.5. Making the population at large computer-literate by means of the mass media (particularly television), and opening clubs and training centres.

1.2.2.6. Giving the Ministry of Communications governmental possibility for leading the handling of IT matters. The Ministry of Communications is to be responsible for promoting and coordinating the development of government IT systems and services, as well as for government activities related to IT and the economy.

1.2.2.7. Making government and general information accessible to the public by means of government-initiated and supported teletext and vidotex systems.

1.2.2.8. Recognition of the Israeli software industry as a high-export-potential productive sector, and giving it comparable development and export incentives to those given to Israeli industry generally.

1.2.2.9. Increasing IT-related standardization in Israel by allocation of the necessary resources (see 3.1.3.).

1.2.2.10. Promotion of legislation on IT and laying down a uniform policy to encourage the setting up and use of data banks.

1.2.2.11. Establishing a nation-wide inter-hospital information network on the admission, discharge and transfer of patients.

1.2.2.12. Reintroduction of statistical surveys on the Israeli computer sector by allocation of the necessary resources.

1.2.2.13. Declaration of an "IT Year" in Israel in 1987. During this year the spotlight will be on information technology, using special media programmes, seminars and symposia, competitions between firms, institutes, government ministries and the educational system, in order to encourage penetration of IT to the economy.

1.2.2.14. Creation of a governmental organizational body whose remit will be to implement the Steering Comittee's recommendations and promote IT generally, as well as setting up an official public body to organize the IT Year.

CHAPTER 2 – THE INFORMATION SOCIETY IN ISRAEL: ECONOMIC AND SOCIAL IMPLICATIONS

2.1 THE INFORMATION ERA

Generally, a society's level of development is measured by the total knowledge available to it and the degree to which it makes use of such knowledge. At the beginning of the nineteenth century, the total accumulation of human knowledge doubled every fifty years: in 1950 it was estimated to be doubling every ten years, while in 1970 the figure had leaped to once every five years. Today, the figure is considered to be doubling every two to three years.

There are two main reasons for this acceleration in the growth rate of mankind's accumulation of knowledge:

1. Developments in computer and communications technologies have led to efficient, reliable handling of increasingly large amounts of information at ever faster rates and with an ever-increasing level of reliability at constantly decreasing costs per information unit.

2. Constant increase in the numbers of people dealing with information both in the work setting and in non-work situations.

The decisive technological factor in this development is the outstanding development of microelectronics. In the last fifteen years, computing power has soared by a factor of ten thousand, while in parallel the price of a computer operation has been slashed by a factor of one hundred thousand. It is estimated that over half of all employees on the American economy today have dealings with information in one way or another. These two factors act on each other: as data handling possibilities grow and become cheaper, increasing use is made of them. Moreover, increase in demand for information services leads to more improvements and technological development, with a concommitant further reduction in unit costs.

The difference between the level of development of technologically advanced and technologically under-developed countries may be equivalent to an information time lag of twenty years or more. There is international consensus that in the future a country's economic status will be determined largely by its information technology (IT) status.

Today there is evidence of the changes taking place in our lives as a result of the technological, economic and social changes being introduced on a comprehensive level by the information era. Changes are occuring at the work place, in daily life, in the educational and health sphere, in government services, and so on. The

information revolution contains an implied promise of a better future, together with a threat to the future of both individuals and the state. It is up to us to influence the process and results of development in such a way as to bring about the welcome and positive effects of the information era. Being able to make forecasts merely enables the taking of steps to promote suitable developments. It is however just as important that suitable priorities be set and the necessary manpower and budgetary resources be designated by all those concerned, be they government departments, public institutions, industry, economic bodies or last but not least, individuals.

The government of Israel recognizes the vital importance of information technology. As a first step towards preparing the country for the information era, the government appointed a Steering Committee for Information Technology. This report summarizes the Plenary Committee's deliberations, together with the reports of its sub-committees, and gives initial guidelines as to the likely impact of the information era on an individual level as well as on the State of Israel in the international arena.

The information era is best described as a world in which individuals have available at their place of work and at home a wide range of efficient, low-cost means of communicating with others as well as of accessing manifold information and data processing resources. The information in question may be presented in many forms — sound, picture or graph, written symbols and so on.

The IT system of the future can be described as consisting of a network of terminals producing varying signals and a vast range of data banks varying widely in content and size, all of which are inter-connected by a communications system reliably and at the requisite speeds permitting transmission between the various components of different types of information at a reasonable price. The basic technical requirements of an IT system are defined in terms of system behaviour with reference to human user needs, and may be summarized as follows:

1. "user-friendly" operation and communications
2. high reliability and accuracy
3. reaction time adapted to human reaction speeds.

In addition to these technical and operational characteristics, the economic aspect must also be taken into account. Operating costs of IT systems must be in proportion to the benefits accruing to the user. There are still various obstacles to overcome beyond the operational requirements in order to fully develop an information society, as well as tackling implementational requirements. The relevant issues of major import and outstanding significance for which solutions must be found on the national and international levels are discussed below.

2.2. ECONOMIC FACTORS IN THE DEVELOPMENT OF IT SYSTEMS

Just like other public-service systems, IT systems are subject to the rules of economy of scale. Initial investment in such systems is relatively high, while the direct cost required to provide an individual subscriber with a service is almost insignificant. When brand-new IT services are developed, there is a basic difficulty in estimating the probable income or profits, whether in terms of the likely market penetration or in terms of user willingness to pay for the service. There is no shortage of examples throughout the world of economic failures resulting from over-estimation of the growth rate of a market for new technologies. Fortunately, the infrastructure for IT systems can be used for a wide range of varied applications, thus enabling investments in the infrastructure to be shared by a large number of services which can be used by many sectors of the economy. Consequently, it can be hoped that the imprecision in estimates of likely demand and returns on investments in various areas will be offset by the very fact that many fields are involved. For the very same reasons, the government and the major economic bodies will have a paramount role to play in developing and helping to implement IT-based systems and services in Israel on a level which will enable them to continue developing on a stable and economically sound foundation.

In order for the IT system to be efficient and of genuine value to the economy, it must satisfy the following three prerequisites:

1. Up-to-date comprehensive data bank system.
2. System to cover the entire sphere of economic activities and society.
3. Hardware base – computers, terminals and telecommunications infrastructure responding to the needs of the economy.

This all requires massive economic investments. According to a very rough estimate, introducing IT on the Israeli civil economy is likely to cost between two and five thousand dollars per employee, i.e. a total of some 3000 to 7500 million dollars, for equipment and acquisition or development of suitable software systems. Training of personnel is likely to cost a further two to four hundred million dollars, assuming that an average of 50 hours of training per employee are required for 60% of the work force. Equipping private individuals with computer terminals or home computers will cost between five hundred million and a thousand million dollars, assuming that each home invests an average of five hundred to a thousand dollars. The necessary expansion of the telecommunications infrastructure so that it can cope with the additional communications needs of the IT system will be the equivalent of adding around half a million telephone lines, which at current network-expansion costs will mean around one thousand million dollars. Thus in order for Israel to attain a high IT standard, it will have to make a national investment totalling between five and ten thousand million dollars. It

should be stressed that this figure is for overall national investment, with the government's share probably being less than 10% of the total.

2.3. ECONOMIC SIGNIFICANCE OF THE INFORMATION ERA

As has already been pointed out, the information era goes hand in hand with far-reaching technological developments. The following are some of the main resultant changes.

2.3.1. Product Changes

Developments in microelectronics technology and software have led to major change in many product fields. These changes generate shifts on price and relative value levels, which in turn affect market size and employment patterns in the sectors producing such items. Thus the Swiss clock and watch-making industry has been seriously affected by the development of digital clocks and watches, which require the assembling of only five components compared with the thousand steps necessary to produce a mechanical clock or watch.

Microprocessors are increasingly penetrating many types of consumer products, including household electricals, home entertainment electronics, cameras, cars and so forth. Basically everything which was previously done by complex mechanisms is now performed by electronic systems, the hundreds of mechanical parts being replaced by one microprocessor, which performs its task more accurately, more reliably and with far less wear and tear. This revolution has a significant effect on product cost, as well as modifying the relative cost of components and labour invested in the manufacturing process.

2.3.2. New Products

As a result of the availability of microprocessors and new communications resources, a market has developed for new products which were totally impractical before the advent of the microprocessor, for technical or economic reasons. Outstanding examples include computer games, public data services such as videotex, and the robotics industry which makes it feasible for various manufacturing processes to be performed at high levels of precision and reliability. These new products have changed individual and public consumption patterns, shifted manufacturing resources and diverted spending patterns from conventional products to new ones.

2.3.3. Changes in Manufacturing and Design Processes

Microelectronics are changing the relative contribution of parts manufacture and labour in production processes. The labour component of many products is constantly being reduced as a result of the new technology. A further factor is the increasing use of robots and other automated equipment on production lines. The two-fold result is a reduction in the labour component as well as an improvement in product quality and productivity. There is no comparison with the number of defective products turned out by human labour. Computer-controlled production lines allow optimum setting of all machine operations and process flow. Where changes in manufacturing processes or products are required, these can often be made rapidly and reliably, simply by changing robot instructions and machine settings, without any training of personnel being necessary.

Computerized production equipment and robots can work in conditions which no human being could operate under. This means that production can take place under the most suitable conditions for that particular item, without any extra investment in order to bring a human worker to the work place.

The availability of high-speed, low-cost computers makes it feasible for computers to perform an increasing proportion of design work. Areas include computer-aided drawing, calculations, simulating the different possibilities with which the designed part will have to be able to cope and studying its behaviour, installation and adjustment of various parts. Thus, for example, it is possible today to design an entire vehicle, to assemble its components and sub-assemblies, to check on the way in which the various components perform under the stresses to which they will be subject, all without actually producing a single metal part. At the end of the designing process instructions can be issued directly for the machine tools department and the assembly shop for manufacturing and other processes. This CAD/CAM approach is revolutionizing attitudes to product development and process flows. The time lag between product conception and finished product is being constantly reduced by computerized design and test possibilities. Customized production is considerably facilitated by the ease with which design and production parameters can be altered.

This all seems to be painting a very rosy picture of a more vigorous industrial and commercial setup with a high-speed product development capacity, turning out higher-quality products more efficiently and more cheaply as a result of more effective use of materials, energy and labour, and so on. However, a potentially gloomy note is struck by the fierce competition characteristic of the market, raging between those on the one hand who have wasted no time in acquiring the new technology and design and manufacturing tools, and the others who for various reasons have not done so. The alternative facing the different sectors of industry and economic activities is a stark one: either to switch promptly to the

new technologies, or to go under. The process of change involves sending shock waves through the entire economy, making major investment in equipment and training, in R&D, in developing new industries to replace those which have closed down, retraining workers and finding them alternative employment, and so on. Given such major changes and the urgency of the matter, the government must assume the major responsibility for steering and guiding the Israeli economy as a whole and providing the necessary tools and resources for ensuring that industry manages to adapt successfully.

2.3.4. Changes in Management Process

The availability of IT systems has a particularly striking impact on management processes in industrial, commercial, government and social systems alike: in short, in every sphere of our lives in which decisions are taken. IT systems provide the manager or decision-maker with tools for data collection at high speeds and large distribution of sources, high-speed processing of collected data and display in the form selected by the user, identification of possible lines of action and computer simulation of their potential outcomes. Decisions taken by decision-makers using IT systems will undoubtedly be superior to those of their non-computerized counterparts. Increased use of IT systems will improve public administration efficiency, as well as reducing the overall load borne by the general public as a result of the administration structure, improving the quality of services to the public and making it more possible to achieve greater justice and fairness in the treatment received by individuals at the hands of the authorities. A countervailing fear is that the authorities will have more control over the individual citizen as a result of the setting up of comprehensive data banks containing detailed information on individuals. Throughout the world legislative bodies are currently tackling this problem. Using the requisite technological and software developments, various countries' legislative systems are working to protect individuals against invasion of their privacy and subjection of individuals to government or other control to a degree greater than the strict minimum necesary for performance of such authorities' tasks, as well as to avoid misuse of personal information in order to exert pressure on individuals.

As the main body responsible for public administration, the government is duty-bound to initiate the development of IT systems for increasing the efficiency of public administration in all spheres, including taxation, education, health, law and order enforcement, employment, social services and many other fields of government-citizen interaction. Consequently it is the government which must promote and encourage the development of IT systems for economic, industrial, financial and commercial applications as well as in all other branches, with the aim of advancing Israeli economic life and improving its position in the merciless international competitive struggle.

In the light of the urgent need for vigorous development of IT systems and applications in administration, the government must undertake detailed legislative initiatives and actions in order to protect individuals in Israel from misuse of the opportunities and power with which IT systems might otherwise provide their operators.

2.3.5. Changes in Employment

The information era naturally has a major impact on the employment front. Not only is there a significant change in the quantity of manpower required for manufacturing and services as a result of the use of computers and communications resources but there is also an essential difference in the nature of human work in the information era. There are changes in the absolute quantity of work required for individual services and products. However, the reduction in work quantity resulting from microelectronic systems applications and the use of robotics on production lines is counterbalanced to some extent by the expansion of quantities produced and the market, as well as by the production of new goods and services. There are of course grounds for apprehension that in the long run essential changes are bound to occur in the patterns of human labour, including shorter working hours, earlier retirement, extension of the period of education and professional specialization, as well as other solutions for dividing resources among the population. According to certain opinions, one of the main problems facing societies and governments in the future will be to find valid life-styles which will provide subsistence and not be based exclusively on the premise of work.

The changes in the nature of employment can be seen in the reduction in the relative amount of manual work, and the increase in human intellectual input. There is a continuous shift towards increasing knowledge and specialization. This in turn forces changes in the educational and vocational training systems on all levels. A young person completing training today cannot manage without a background in IT matters. The Israeli educational system has started to adopt the use of computers in its curriculum several years ago, and certain achievements can already be seen. Unfortunately, however, the amount of training required has grown at a pace which is being increasingly outstripped by the rate at which IT is being introduced to the curriculum.

2.3.6. Standardization in the IT sphere

A crucial factor in the development of IT systems is the compatibility of the various components making up such systems. In order for users of the system to be able to be interconnected and use the various data sources, there must be a common "language". International standardization bodies are investing major

efforts in developing international agreements on IT standards. Switching to a compatible system is a very lengthy, difficult and expensive process. It is therefore of vital importance that all parties involved in IT matters in Israel be both actively and passively involved in the evolution of international IT agreements and standards. It is particularly important to ensure that new developments conform with the new standards and will be able to be adapted to the expected changes. In addition to participation in standardization work on an international level, there is an urgent need for national standardization on matters of particular relevance to Israeli IT problems, including the Hebrew language, multi-language use, data bank structure and other subjects which have not yet been dealt with in international standardization bodies but are being tackled on a national level in individual countries.

All of these standardization issues require appropriate organizational measures in Israel, together with national efforts in order to produce a standards system which will deal adequately with the needs of the information era, as well as contributing to its rapid and effective development in Israel.

2.3.7. Interests of Owners of Information

One of the aims of developing IT systems is to improve access to all types of data by those in need of it. This is in opposition to the interests of those owning such information, whether on an individual level, an organizational level or nationally. Information is a special commodity: its value is in being available to the person who needs it, and when it is passed from one party to the other it becomes the possession of both parties. When information is transferred, the provider of such information loses the relative advantage over the person who did not previously possess such information. This problem exists on an inter-organizational level as well as in inter-personal relations within organizations.

If an information society is to develop, basic solutions have to be found to the question of information ownership and rights, and acceptable rules must be developed for governing information exchange between individuals, organizations and states. Given the economic and security value of information, satisfactory methods have to be found for guaranteeing the rights of owners of information, by means of enactment and enforcement of legislation on the one hand, and by technical data protection methods on the other hand. One of the problems facing the legislator in this area is that of transborder data flow (TBDF). Professional circles are currently struggling to solve this problem, but they do not appear to have any simple solutions. Issues include import and export taxes on information and software transmitted via telecommunications channels and enforcement of legislation on privacy. To erect barriers as a way of dealing with the flow of information via telecommunications channels is not a valid approach to the problem, both for technical reasons as well as in terms of international

commercial scientific information and cultural relations. The only viable alternative is to invest in research to find suitable technical and legal solutions. Such solutions must strike a balance between protecting rights and ownership of information on the one hand, and not impeding the development of the information era on the other. Appropriate methods must be found for achieving this balance. Tardiness in acting on these matters is likely to have a harmful effect on the vital interests of economic bodies in Israel, as well as on the State as a whole.

2.4. THE INDIVIDUAL AND THE INFORMATION ERA

This section discusses the impact of the information era and its innovations on the life of the individual, his or her actions, the effect on professional life, relations with governmental institutions, administrative and business systems, and so forth.

2.4.1. Individual Life Styles in the Information Era

As outlined in the preceding section, technological changes and automation of production design and office processes will lead to a reduction in the amount of manual labour required. One of the most obvious effects of this is the change in the balance between leisure time and the number of employment hours which the individual "sells" to others. This trend is generating increasing social and communal problems. Efforts must be invested in developing a "leisure culture". Resources have to be earmarked for developing suitable infrastructure for leisure time activities, including sports and entertainment facilities, developing hobbies, providing courses for all levels, and so on. Moreover, educational activities, instruction and proper presentation of the leisure society are also of prime importance.

One of the problems already facing us today is the "retirement crisis" syndrome. When workers who have devoted the larger part of their adult lives to work are forced to retire, they reach a crisis point, and are sometimes destroyed by their struggles to cope with a problem with which they have no training – leisure. As retirement is taken earlier and earlier in the information era, this problem will worsen steadily, and steps should be taken in good time to learn how to deal with it. Counterbalancing the growth in leisure resulting from the reduction in demand for labour are other processes generated by the information era. The need for highly-skilled personnel lengthens the requisite period of education, while more on the job training is provided, thus reducing the "net work life" of an employee, while at the same time sharing available work among more employees. A second aspect is the development of a long list of leisure activities based on state-of-the-art technologies and IT resources. Both general educational and vocational training systems need to give IT-related subjects prime positions on all

levels of their curricula. The government must promote and encourage the development of matters related to the leisure culture, whether in the field of IT-based subjects or not. The development of a leisure culture is a long-term issue, and the government should start considering it now rather than later.

One vital area worth mentioning here is the use of technology and IT to improve the life of handicapped people. The necessary resources and investments in this area are likely to be amply repaid by the savings on assistance and the rehabilitation of the handicapped person as an effective and productive member of society.

2.4.2. Employment

We are now facing a new situation, where the rate of technological development is such that methods and means of production are changing faster than the natural turnover rate at places of work. In an employee's "work life" there will be several technological generations' worth of changes in equipment and methods. This situation makes it difficult for workers to adapt, as well as generating management problems when it comes to effective admistration at work. As IT and information systems become increasingly sophisticated, understanding properly what they do requires an ever-increasing level of specialist knowledge. Another major problem created by the accelerated pace of technological change at work affects labour relations. In the past, there was a direct relationship between an employee's age and seniority, and his or her professional status and expertise. Today, a situation is developing in which a worker who has just graduated knows far more than experienced senior personnel. This situation leads to opposition to innovation, tension and a refusal to cooperate on the part of staff. In order to deal with such reactions, there must be instruction and in-service further training of workers throughout their professional lives. Employee may have to be transferred to jobs which require labour. Employees often fear that the computer is going to replace them. Experience has shown that the introduction of a computer or an IT system on an administrative level does not lead to reduction in personnel numbers in the short term. The immediate impact is primarily on quality and efficiency; it is only at later stages that a gradual, controlled process of stepped reduction of staff can take place in accordance mainly with natural attrition of staff for various reasons. In the manufacturing and manual labour spheres, there are grounds for complaints that workers suffer from the introduction of robotics and automation. There is no lasy ready-made solution to this problem, as refraining from automation will simply bring about the collapse of the firm as a result of competition from companies which have automated.

Government initiatives are needed in order to educate the public and increase both awareness of and involvement in all IT-related matters. Such efforts should be directed at bringing about radical changes in the public's attitude to

information technology, so that it switches from one of puzzlement and fear to one of understanding and interest in its multiple applications. A computer-literate public who can use IT systems intelligently will be interested in developing applications for it which will accrue to the benefit of both individuals and the country as a whole.

Care should be taken to ensure that new systems for general use are designed to be user-friendly, in order to avoid creating negative user attitudes in the early stages of operation. There is a well-known phenomenon of disappointment with the way a new system works as a result of insufficient familiarity with it, leading to rejection of the system. Such unfavourable attitudes are very difficult to correct, and therefore everything possible must be done to avoid such reactions when new technologies and working methods or public applications are introduced.

2.4.3. Privacy

The main danger resulting from infringement of an individual's privacy is misuse of personal information for the advantage of the person holding that information, leading to harassment of harm to the individual. Developments of computers, data banks and communictions networks have made it possible to store, manipulate and retrieve information in quantities and at speeds unknown and unimaginable in the past. The ability of IT systems to store unlimited quantities of data for an unlimited time, to process and sort them at exceptionally high speeds and make them available almost immediately to the person in control of the system puts individuals' privacy at risk.

Privacy is a person's ability to decide how and under what circumstances to reveal private matters and information of personal relevance. Rules must be developed to avoid misuse of personal information whether by governmental bodies or by some other interested party. A further danger results from the fact that individuals are not aware of what information has been collected on them, and incorrect information, whether unintentional or deliberate, is likely to harm individuals without their being able to do anything about it.

Legislation on privacy is being tackled by many countries. There are laws prohibiting unauthorized access to personal data banks. Other regulations include banning inter-connection of personal data banks, an obligation to allow access to personal information by the individual concerned, mandatory correction of inaccuracies and errors and their consequences, as well as legislation designed to increase individuals' control over what is to be revealed and to avoid matters being revealed without the consent of the person concerned.

Countervailing factors include the efficiency of administrative and public systems in discharging their duty, law enforcement, preventing various offences, and

providing services to the individual in areas such as health, education and employment. Major differences in approach exist between different state systems, and research scientists and philosophers tackling the problem have not yet been able to agree on the right concepts.

Methodical research and reflexion are required in order to work out a social and conceptual approach to the management of personal data which will be in line with the conceptual foundations of Israeli public and social life, as well as developing the requisite technical and organizational tools for implementing such an approach to the management of personal information.

2.4.4. The Individual's Relationship with Society

The information era generates far-reaching changes in the relationship between the individual, society and the authorities. IT systems allow individuals to access many information sources rapidly and without third party intervention. Thus the individual is not only able to obtain faster, improved service, but is also no longer obliged to rely on the services of an omnipotent and omniscient civil servant. The nature of the government-citizen relationship may well be totally modified by such developments. The process is a two-way one: in addition to a flow of relevant, up-to-date information to the citizen on request, IT systems make it possible for citizens to transmit information to the authorities in a format suitable for storage, sorting and processing into conclusions in a high-speed, and objective fashion. Such a facility permits more active participation by citizens in the processes of government, by means of referendums and individual participation in the process of communication between elected representatives and the public.

IT systems provide a previously unknown communications medium which for the sake of demonstration and simplicity we will define as an electronic mail box for texts. The system can be accesed at athe user's convenience at any time from anywhere. "Conversations" can be held in which large numbers of people can participate at different times and from different places, with the possibility of going over the "conversaiton" as often as they wish. The advantages of this medium are that it allows extremely efficient use of participants' available time, permit all participants to express themselves fully, and allow matters to be dealt with properly without time or geographical constraints. These facilities have a radical impact on the individual's ability to participate in society, including relationships with government agencies, economic corporations, social organizations or any group of people with common interests. Experience acquired in business setups equipped with such systems shows that an individual's attitude to the organization changes significantly as a result of such possibilities for participating in greater depth. It has also been found that different personal qualities are appreciated than those considered important under other communications systems.

2.4.5. Government Role and Function

Many likely developments and influences on individuals' lives resulting from the information era are discussed above. Some of the consequences will have a positive effect on individuals' life patterns and happiness: others are likely to have a harmful and negative influence.

There are still many queries about desirable lines of development for the information era. Research, study and intellectual developments are all required in order to come up with answers to these as yet unresolved questions.

Various infrastructures are indispensable for the development of the information era. The crucial resource is the human one. A drastic change will have to come about in professional manpower distribution in various economic spheres, for which major changes in the educational curriculum are indispensable. As a first step towards such changes, a foundation must be created of suitably trained teachers and instructors, who will act as guides to students entering the information and IT world.

Another human foundation more specific to IT matters is a stratum of specialists who will develop and construct IT systems. These include computer scientists, programmers, systems analysts, computer and communications engineers, as well as the corresponding technicians. The numbers and quality of these specialist personnel will have a decisive influence on the performance and speed of development of IT systems in Israel. With the exception of technicians, these professionals are not being trained at a sufficient rate, vigorous efforts are required in order to increase the numbers of university graduates in IT disciplines.

Another type of infrastructure is telecommunications, through which information flows from user terminals to computers and between computers. the number of data-transmission leased lines in Israel is roughly equal to the number of installed computers (excluding personal and micro-computers). This number is lower than expected, since it implies that in Israel on average each computer is connected to only one terminal (or collection of terminals all at the same location) while the other terminals are connected to a computer in the same building or on the same premises. This figure needs to be compared with the number of terminals operating in Israel, estimated at an average of some 15 terminals per computer. The response by the Israeli telecommunications company, Bezek, to applications for line installations needs to be improved. Lines must also be brought up to international levels of reaction and quality. Similarly, the Israpet network and its national and international channels must be expanded in order to provide the level of service expected of such networks. Steps must be taken in the near future in order ot ensure that demand can be satisfied and that a modern telecommunications infrastructure is deveoped suitable for a State whose development is based on the resources offered by the IT systems of the information era.

CHAPTER 3 – SUB-COMMITTEE CONCLUSIONS

3.1 RECOMMENDATIONS ON ISSUES OF COMMON CONCERN

This chapter deals with the overall recommendations of the sub-committees. Although each sub-committee dealt with a different aspect of information technology, there were naturally areas of overlapping and common concern to all the sub-committees. These six common areas are given below, with a summary of the positions of the various sub-committees.

3.1.1. Telecommunications Infrastructure

The first topic to be referred to by almost all the sub-committees, although there was a special sub-committee on the subject, was the telecommunications infrastructure in Israel. Practically all sub-committees spoke of the need for immediate enhancement and improvement of Israel's telecommunications infrastructure, as an indispensable prerequisite for developing IT systems in general as well as in the specific subject areas of each committee's remit. The telecommunications infrastructure sub-committee stressed the need to accelerate implementation of communications solutions for IT applications, including accelerated installation of point-to-point lines, rapid expansion of the public data communications network (Isranet), and expeditious changeover to a digital telecommunications infrastructure to deal with both the telephone shortage as well as promoting the development of Israel's telecommunications infrastructure. The telecommunications infrastructure sub-committee emphasized the importance of an integrated, coordinated effort by the Israeli Telecommunications company, Bezek, and industry jointly in order to set up and implement an integrated services digital network (ISDN) with a target of commercial application before 1990.

The sub-committee for *IT in the Health Sector* emphasized the need for a suitable, improved telecommunications infrastructure in order to implement its recommendation for the establishment of a nation-wide inter-hospital information network on the admission, discharge and transfer of patients throughout Israel. The sub-committee on *Services for the Individual* recommended more immediate switching to a digital telecommunications system, as well as reinforcing the Isranet network, in order to provide a suitable telecommunications infrastructure for the needs of Israel's current and future IT systems in years to come. Another recommendation was that in developing an infrastructure for citizens' IT services there be fair geographical coverage and one price for all users. The subcommittee for *Research and Higher Education* recommended that the link between Israeli academic institutions and bodies abroad be further developed. The sub-committee on *IT in the Government Sector* recommended the operation of a data communications network for government applications. The sub-committee for *IT*

in the Industry & Business Sector recommended improving communications services for business users, upgrading the availability of existing services, developing new services, encouraging greater flexibility of intra-organizational services, and reducing the cost of services in order to aid their penetration to the economy. The sub-committee for *Technologies* recommended the establishment of a system based inter alia on a state-of-the-art communications network linking computer centres, data banks and work stations throughout Israel.

3.1.2. Education and Training

The second topic of common interest to all the sub-committees is the field of education and training. On the one hand there is an urgent and vital need for educating and training both the general public and also professionals for the IT era, while on the other hand information technology has an enormous potential as an educational tool which can be applied to the fields of education, training and scientific reserach in order to bring about improvements, enhance effectivenes and generally contribute to progress. A vital prerequisite for achieving these two facets is the availability of a pool of qualified IT specialists.Several of the sub-committees therefore made reference in their recommendations to ways of proving incentives for and increasing the numbers of academic personnel in university IT fields, as well as methods for making more effective use of their knowledge generally.

Other aspects covered by the sub-committees include IT teaching and IT-aided teaching in schools, public awareness, (see 3.1.4. — Data Bases) computer-assisted teaching in the health sector, training of staff in the government sector and increasing awareness of information technology, in addition to technological training on post-secondary and university levels.

The sub-committees for *IT in Education* and *Employment and Social Impacts* recommend that a top priority rating be given to the computerization of the educational system. In this context, the sub-committee for *Technologies* recommended a national programme for developing computer-assisted teaching systems. The sub-committee for *IT in the Health Sector* also recommended the development of computer-assisted teaching in the fields of medicine. The sub-committees for *IT in Education* and *Employment and Social Impacts* together with those for *Services for the Individual* and *Research and Higher Education* recommended the development of a national programme for making the adult population aware of computers (by means of the mass media, the Open University, Community Centres and so on). The sub-committees for *IT in Education, Employment and Social Impacts* and *Research and Higher Education* recommended the establishment of a fund for promoting computer studies in universities, setting up a board to coordinate university and industry activities, making arrangements which would permit Israeli academics to spend their sabbatical in Israel, and vigorous efforts to promote the immigration to Israel of

IT specialists as well as to bring back to the country Israeli IT experts currently living abroad. The sub-committee for IT in the *Government Sector* recommended making senior civil servants more aware of IT applications as well as outlining a manpower policy for IT specialists in the government sector.

3.1.3. Standardization

The third subject of common concern to all the sub-committees is that of standards. This involves the establishment of approved standards in order to allow communication between different systems and bring about considerable economic savings for both the public system, with particular reference to the governmental system, and also industrial systems. The need for standardization applies to communications protocols, software and data banks (see separate section), as well as to hardware.

All the sub-committees spoke of the need for centralized, coordinated action in order to lay down uniform specifications in order to ensure compatibility and communications between systems. However, the possibility of decentralization and multiplicity should not be rejected. The standardization process calls for a prudent, open-minded approach in order to avoid creating barriers to development of technology and IT systems. The *Telecommunications Infrastructure* sub-committee recommended more rapid adoption of communications standards. The responsible authorities should set standards for the quality of communications services and the connection of equipment to communications networks, as well as stipulating a mandatory Israeli encription standard for civil applications. The sub-committee for *Services for the Individual* recommended the adoption of fast, flexible procedures for the approval of dedicated data-communications equipment, the setting of minimum approved requirements for equipment for the transmission of data to telephone lines, and the adoption in he near future of regulations on communications protocols. The subcommittees for IT in the *Health Sector*, in the *Government Sector* and for *Research and Higher Education* also stressed that standardization is necessary for implementation of their recommendations.

3.1.4. Data Bases

One of the subjects common to most of the sub-committees was the establishment of new data bases, the increasing of access to existing data bases and the provision of communications between them. As has already been pointed out, one of the outstanding features of the IT era is the way in which all types of information become a day-to-day, highly accessible commodity. All the sub-committees made the point that data base must be set up and easy access to them provided in the various areas with which the different sub-committees dealt.

The sub-committee for *IT in the Health Sector* referred to the setting up of a data base on medicines. The sub-committee for *IT in the Industrial & Business Sector* recommended the development of an economic data base to service the economic sector. The sub-committee for *IT in the Government Sector* spoke of setting up three national "super" data bases, setting up a computerized data base for files and software packages in government use, as well as the need for switching in the more immediate future to on-line data transmission to the public, with particular reference to *The Central Bureau of Statistics*. The sub-committee for *Services for the Individual* also recommended giving the public access to those government data bases whose information may be published. The sub-committee for *IT in Education* recommended establishing national (libraries) electronic data bases to which schools' systems and community centres will be connected. The sub-committee for *Employment and Social Impacts* recommended setting up a national information centre as part of the employment services, to include information on manpower and employment in the IT field (and later on all occupations) to be used by institutions which train and employ labour as well as for individuals' use.

3.1.5. Privacy and Confidentiality

Various sub-committees referred to the need for greater attention to the need for privacy and confidentiality, in order to be able:

a) to develop state-of-the-art data systems without infringing the individuals' privacy;
b) to make increased use of IT systems, permitting applications and developments which are not feasible today due to inadequate confidentiality in areas involving personal and economic information, etc.

The *Telecommunications Infrastructure* sub-committee recommended that the Attorney General be asked to draft a bill on security and confidentiality in information technology. The sub-committee for *Legislation and Data Bases Policy* followed the same line of thinking, and urged that the Ministry of Justice act to issue appropriate legislation. A similar approach was outlined by the sub-committees for *IT* in the *Health Sector*, in the *Government Sector* and for *Services for the Individual.*

3.1.6. Taxation

Various sub-committees considered the question of taxation, both in terms of importing of computer and communications equipment and in terms of specialist manpower as a way of encouraging the development of IT applications in the Israeli economy.

The sub-committee for *IT in Education* recommended tax exemptions for computer equipment to be used in schools. The sub-committee for *IT in the Industrial & Business Sector* also referred to the possibility of tax reductions on equipment as a method for increasing IT penetration into the economy. The sub-committee for *IT in Education, Employment and Social Impacts* and *Research and Higher Education* stressed the need to make arrangements which would allow Israeli university and industrial staff to spend their sabbatical and professional further training periods in Israel. The sub-committee on *Research and Higher Education* proposed tax exemption of contributions made by industry to the Academia.

APPENDIX

List of Plenary Committee Members

Dr. Jehuda Kella	— Chairman, Chief Scientist, Ministry of Communications
Dr. Menachem Tassa	— Deputy Chairman, Advisor for Advanced Technologies, Ministry of Science & Development
Prof. Shalom Abarbanel	— Department of Mathematics, Tel-Aviv University
Dr. Yoel Adir	— Computational Centre, Refael
Dr. Roni Atar[1]	— Formerly from the Computers Department, Bank Discount
Mali Baron[2]	— Budgets Division, Ministry of Finance
Yoram Barsela	— Deputy Legal Advisor to the Government, Ministry of Justice
Abraham Bitzur[3]	— Former Advisor for Computer Affairs, Ministry of Finance
Prof. Zeev Frankel[4,5]	— Department of Nuclear Physics, Weizmann Institute for Science
Shmuel Friedrich[2]	— Former Director General of the Ministry of Economics & Interministerial Coordination, currently Director of Sheldor Ltd.
Prof. Abraham Gintzburg	— President of the Open University
Dr. Gideon Halevi	— Formerly from Israel Military Industry, currently from AI-Robotics Ltd.

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1 appointment terminated 23.8.84
2 appointed 17.10.83
3 appointment terminated 17.10.83
4 appointed 3.2.83
5 appointment terminated 27.11.83

Shlomo Herskovic	— Department of R&D Economics, National Council for Science & Development
Prof. Yaacov Katzenelson	— Faculty of Electronic Engineering, Technion
Carl Keren[6]	— Former Director, Centre for Scientific & Technological Information, Ministry of Energy & Infrastructure
Prof. Aryeh Lavi	— Former Chief Scientist, Ministry of Industry & Commerce
Gideon Lev[2]	— Director, Curnet Ltd.
Yair Levin	— Ministry of Education
Zeeva Levy[7]	— Former Director, Centre for Scientific & Technological Information, Ministry of Energy & Infrastructure
Yaacov Lorberboim	— Director of the Instructional Television Centre
Yosef Maayan[8]	— Elron Electronics
Israel Meidan	— Former Director of the Israel Institute of Productivity
Dr. Dan Milin	— Advisor for Computer Applications in Training Systems
Avi Peri	— Formerly from IDF, currently Director of Clal-Maarachot Ltd.
Prof. Shmuel Pinhas	— Head of Hadassah Medical Centre
Benjamin Peled	— Director, Elbit Ltd.
Prof. Kenneth Price	— Mechanical Engineering Faculty, Ben-Gurion University

6 appointment terminated 11.11.84
7 appointed 11.11.84
8 appointed 29.8.84

Prof. Yosef Raviv	— Director, Scientific Research Centre, IBM Israel
Prof. Zvi Rizzel	— Applied Mathematics Department, Weizmann Institute for Science
Colonel Daniel Rosenne	— Signal & Electronics Corps, IDF
Yaacov Saphir	— Director of the national Council for Research & Development
A.D. Sela[3]	— Cur Ltd.
Prof. Eliyahu Shamir	— Mathematics & Computer Sciences Department, Hebrew University in Jerusalem
Prof. M. Sneider[9]	— Formerly from Bar Ilan University
Gideon Snir	— Budgets Division, Ministry of Finance
Prof. Yaacov Shveika[4]	— Mathematics & Computer Sciences Department, Bar Ilan University
Catriel Tzimet	— Head of Systems Analysis & Data Processing Department, Telerad Ltd.

9 appointment terminated 3.2.83

List of Chairmen of Subcommittees

Subcommittee for Legislation & Data Bases Policy	— **Yoram Barsela**
Subcommittee for Services for the Individual	— **Gideon Lev**
Subcommittee for Employment & Social Impacts	— **Israel Meidan**
Subcommittee for Technologies	— **Benjamin Peled** (till 1.4.84) **Yosef Maayan** (from 1.4.84)
Subcommittee for IT in the Industry & Business Sector	— **Dr. Roni Atar** (till 28.3.84) **Catriel Tzimet** (from 23.8.84)
Subcommittee for IT in the Health Sector	— **Prof. Shmuel Pinhas**
Subcommittee for Research & Higher Education	— **Prof. Zeev Frankel** (till 27.11.83) **Prof. Yosef Raviv** (from 1.1.84)
Subcommittee for Telecommunications Infrastructure	— **Colonel Daniel Rosenne**
Subcommittee for IT in Education	— **Prof. Yaacov Shveika**